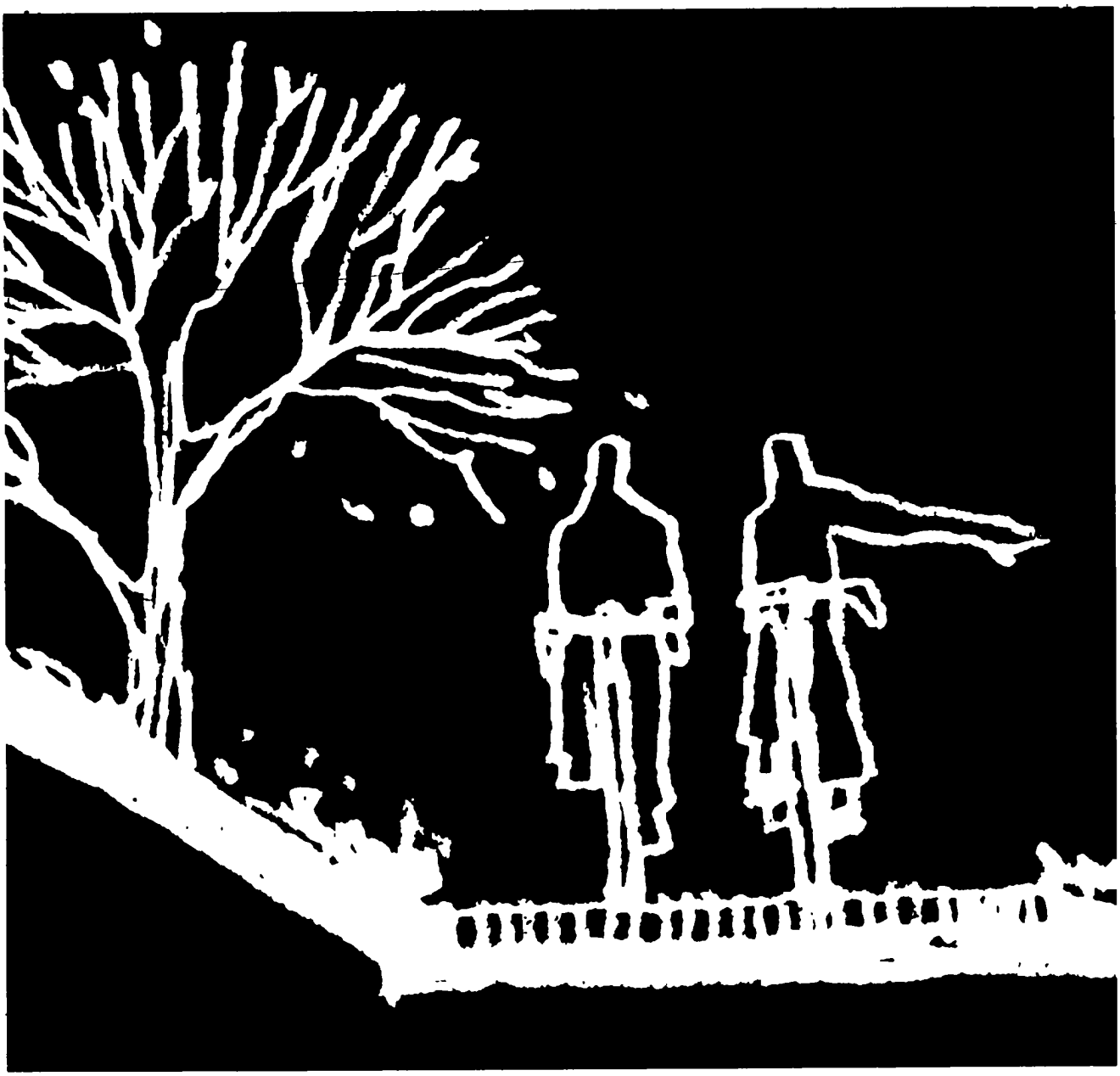
Since the late 1960's, the popularity of the bicycle as a means of recreational and destination oriented travel has increased dramatically. The energy crisis, concern for physical fitness and increased recreational time are primary factors influencing this surge in bike ridership. Increased use of bikes on military installations can easily be observed. The resulting pressure for better and safer facilities for bike travel and storage will increasingly be felt by installation planners and engineers. Bike travel should be encouraged not only to conserve energy but also to reduce automobile parking requirements.



Section I:

Observations and Objectives.

9-1.
Typical Problems.
A. Bikeway Networks.
The current state of bikeway facilities on most installations leaves room for much improvement. Typically, few provisions have been made for bike traffic. Bicyclists commonly are forced to share either the street with cars or the sidewalk with pedestrians, creating unsafe conditions for motorist, bicyclist and pedestrian alike *(fig. 9-1).* When bikeway provisions have been made, they are often incomplete networks that do not link employment centers and housing areas.

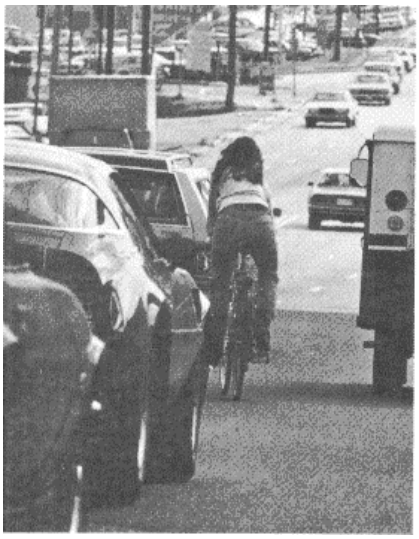


fig. 9-1.

established demand requires development of safe

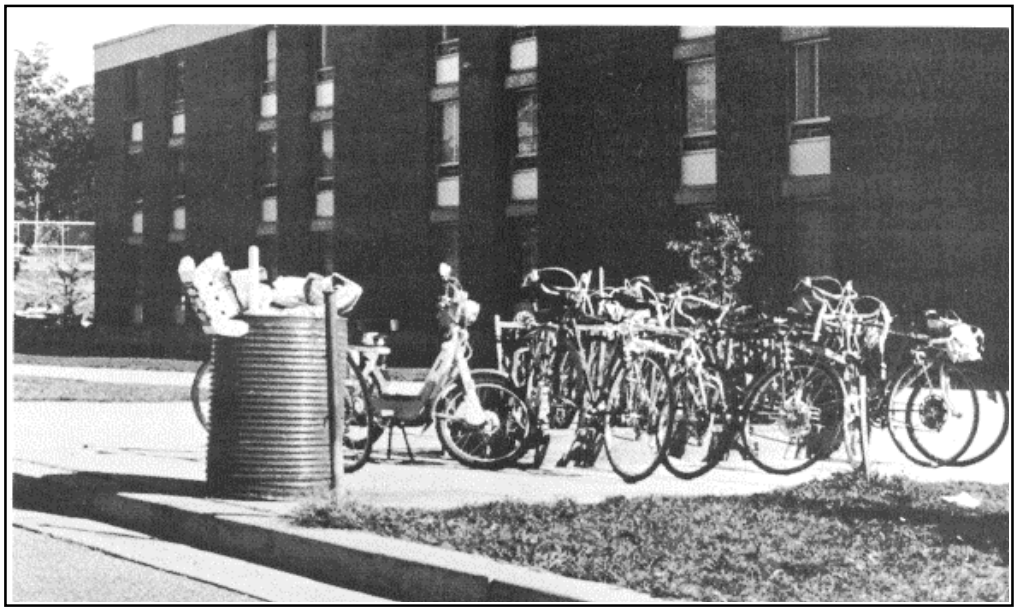


fig. 9-2.

B. Bicycle Parking Facilities.
In many instances, the size of the bicycle parking area does not meet the demand *(fig. 9-2).* Cone sequentially, sidewalks and building entrances are blocked with the overflow. In other cases, bike racks are sometimes underutilized because they have been poorly located. Proper consideration for location and demand is necessary to provide attractive and convenient bike parking facilities.

9-2.
Objective.
A. Develop Bicycle Facilities as a Component of the Installation's Circulation System.
The development of bike facilities may be justifiable in response to existing demand. In addition, the encouragement of bicycle use within military installations can contribute to lessening the negative impact of the automobile and to meeting energy conservation objectives To achieve these goals and to meet the and properly located bikeways as a part of a balanced, multimodal transportation system.
B. Establish a Direct, Continuous and Safe Bikeway Network.
A bikeway system should provide direct routes between primary traffic origins and destinations within an installation. This network should be continuous to facilitate and encourage bike usage. Safety considerations in bikeway design include minimizing potential conflicts between bikes, pedestrians and vehicular circulation and eliminating potential stationary hazards along the bikeway network.
C. Develop Attractive and Convenient Bicycle Parking Areas in Response to Demand.
Bicycle parking areas should be designed and located to be both convenient and adequately sized. Care must be taken to avoid impeding pedestrian flow along walkways and at building entrances.

Section II:

Design Guidelines.

9-3.
Bikeway Classification.
Bikeways are to be designed according to the following classification system which defines the types of bikeways and their degree of exclusiveness for bicycle use.

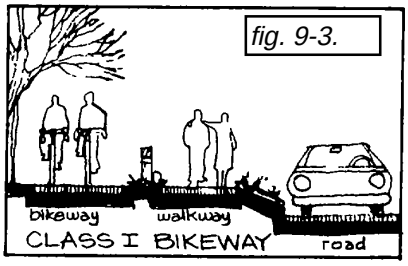


fig. 9-3.

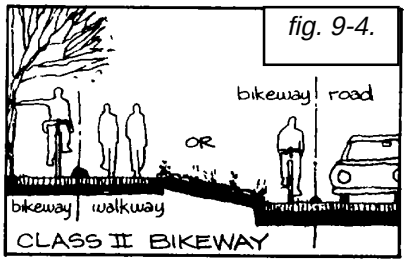


fig. 9-4.

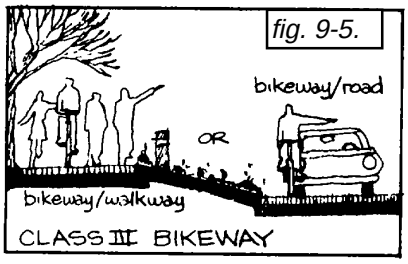


fig. 9-5.

A. Class I Bikeway.
This is a completely separated right-of-way designated for the exclusive use of bicycles *(fig. 9-3).* Pedestrians and motorists crossing the bikeway should be discouraged from doing so.

B. Class II Bikeway.
This is a right-of-way restricted for the semi-exclusive use of bicycles *(fig. 9-4).* Through travel by motorists or pedestrians is discouraged. However, crossing over by pedestrians and motorists is allowed.

C. Class III Bikeways.
This is a right-of-way shared with either moving motor vehicles or pedestrians *(fig. 9-5).* The right-of-way is identified by signs or graphics stenciled on the pavement.

fig. 9-6.

9-4.
Bikeway Design Standards.
A. Width of Pavement.
Establish bikeway pavement widths depending on the classification of the bikeway.

1. Class I Bikeways.

a. The minimum recommended width of an isolated Class I bikeway is 8'-0" *(fig. 9-6).* This allows two-way bicycle traffic as well as maintenance trucks.

b. The minimum recommended width of a one-way Class I bikeway adjacent to a sidewalk or roadway is 6'-6" *(fig. 9-7).* The adjacent roadway provides access by maintenance trucks. Two-way bikeways along roadways are not recommended because of the resultant intersection difficulties. The 6'-6" width allows one bicyclist to pass another.

2. Class II Bikeways. A continuous or intermittent curb is often utilized to provide the partial separation that is required for a Class II bikeway.
When positive separation such as this is utilized, the minimum recommended pavement width

fig. 9-7.

for a one-way Class II bikeway is 6'-6", the same as for a one-way Class I facility.

3. Class III Bikeways.

Because the right-of-way is shared with either pedestrians or motor vehicles, these alternatives should only be used where traffic volumes are moderate to light.

a. Where one-way bicycle traffic will share the right-of-way with pedestrians, 4'-0" of pavement width should be added to accommodate bicycles *(fig. 9-8).* Since 6'-0" is the minimum recommended width for moderate two-way pedestrian traffic, this would result in a 10'-0" total pavement width. The bikeway should be identified with a painted stripe and signing. With this minimum width, one bicycle passing another would have to encroach on the pedestrian area. If heavy bicycle or pedestrian volumes make this encroachment unacceptable, a 6'-6" addition to the walkway pavement width would be required, resulting in a total pavement width of 12'-6".

fig. 9-8.

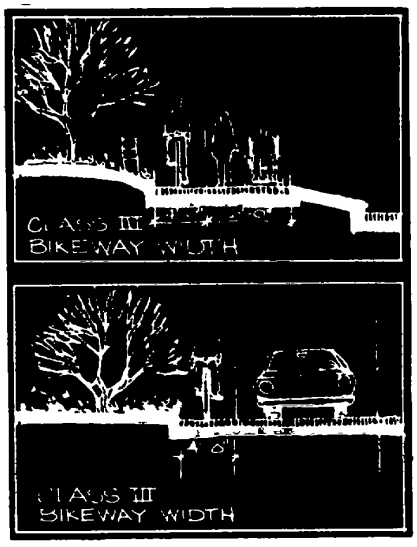


fig. 9-9.

b. Where one-way bicycle traffic will share the right-of-way with motor vehicles, a 4'-0" pavement width should be reserved for bicycle travel *(fig. 9-9).* With an eight-foot lane for parked vehicles and a ten-foot lane for moving vehicles, this would result in a 22'-0" pavement width from the curb to the centerline of a tertiary street. With this minimum width, one bicycle passing another would have to encroach on the moving vehicle lane. If heavy bicycle or vehicular volumes make this encroachment unacceptable, a reserved 6'-6" pavement width would be required. In many cases, the only way to reserve this much pavement width along both sides of existing streets for bikeways would be to eliminate parallel parking. In addition to painted stripes, this alternative requires stenciled graphics on the pavement to identify the bikeway lanes.

B. Clearances.

Provide space for the cyclist based upon the following dimensions:

1. A 1'-6" minimum (2'-0" desirable) horizontal clearance is required from the edges of the bikeway surface to any stationary obstacle, change in grade, or soft shoulder (*fig. 9-10).*

2. An 8'-6" minimum (10'-0" desirable) vertical clearance should be provided from the surface of the bikeway to any overhead stationary obstacle.

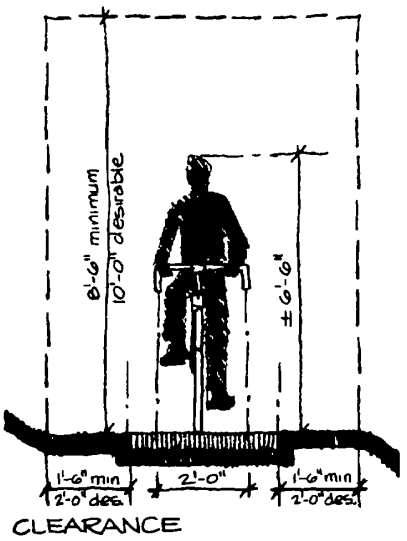


fig. 9-10.

C. Grades.

Relate bikeway gradients to the length of grade. While a maximum of +4.5% grade is desirable, a +10% grade is acceptable for distances less than 50 feet. These recommendations are primarily applicable to isolated Class I bikeways *(fig. 9-11).* For Class II and III bikeways, the gradients of existing street rights-of-way may in some cases exceed these desirable grades, and this should influence route selection. For one-way segments of bikeways, descent grades may exceed these recommendations.

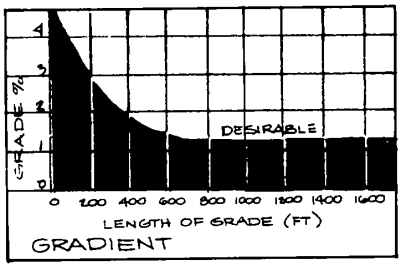


fig. 9-11.

D. Design Speed, Radius of Curvature and Superelevation.
Utilize the following design speeds for isolated Class I bikeways:

Grade	Design Speed
+3% or more	15 mph
+3% to -7%	20 mph
-7% and steeper	30 mph

Based upon these design speeds, the radius of curvature and superelevation may be obtained from the accompanying chart *(fig. 9-12).* If pedestrians will constitute a significant portion of the traffic, the superelevation should not exceed 0.06 feet per foot.

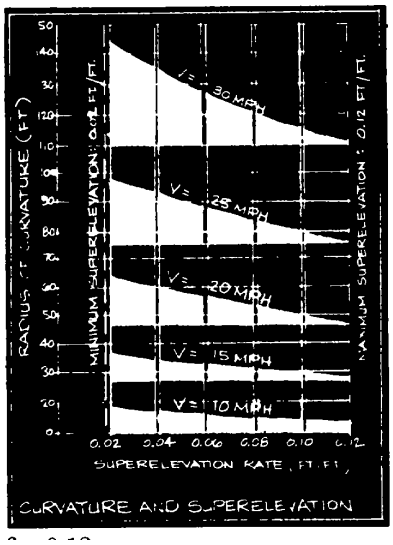


fig. 9-12.

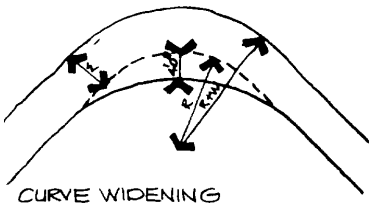


fig. 9-13.

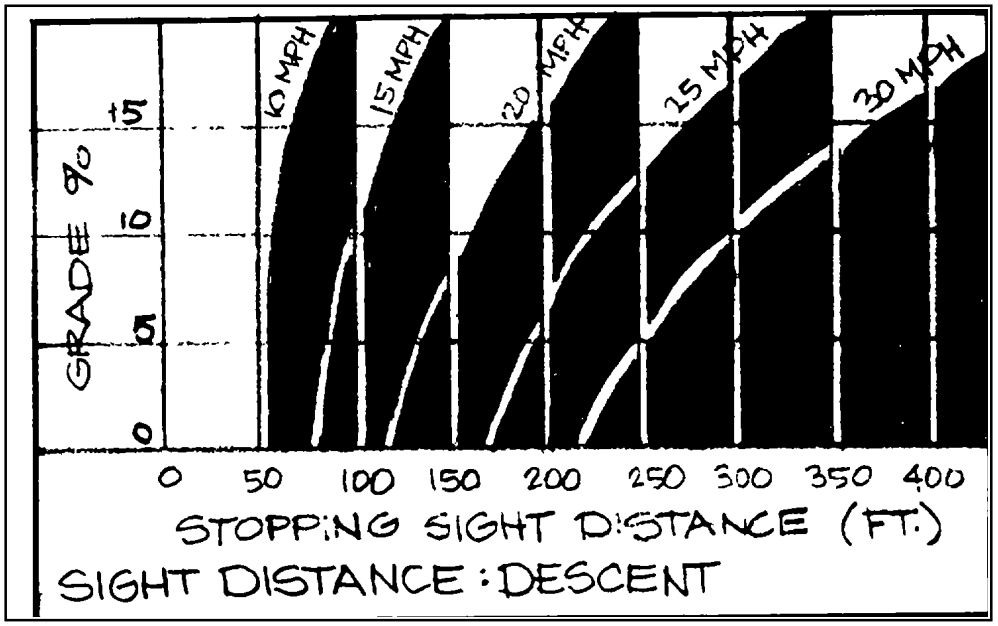


fig. 9-14.

E. Curve Widening.
Increase the width of the bikeway at a short radius curve (less than 100 feet) up to a maximum of four feet in order to provide additional lane width for cyclists leaning to the inside of a curve *(fig. 9-13).*

F. Sight Distance.
Utilizes the accompanying chart to relate bicycle speed and bikeway gradient to bicycle stopping distances *(fig. 9-14).* Use these distances as guides in providing adequate sight and warning distances at all locations of possible conflict, such as at intersections.

G. Paving Surfaces.

1. Class I Bikeways.

a. Design the pavement section of Class I bikeways in consideration of loading, local soil conditions and drainage. Class I bikeways should be designed to support an 8000-pound maintenance vehicle making infrequent trips. It is recommended that either asphaltic concrete or Portland cement concrete be utilized as the surface material. Although installation costs are higher for these materials than for loose aggregate and natural surfaces, wearing life is longer, they may be used in all weather conditions, and maintenance requirements are less.

b. Recommended Class I bikeway pavement sections are illustrated *(fig. 9-15).* The area adjacent to the bikeway surface should be back-filled to the bikeway surface grade, using topsoil, to reduce the hazard of running off the edge and to prevent edge chipping of the bikeway surface.

2. Class II and III Bikeways.

a. Normal pavement sections provided for sidewalks and roadways are generally acceptable for Class II and III bikeways. However, since bicycles do not have shock-absorbing suspension and tire pressures are high, pavement surfaces and expansion joints should be constructed and maintained as smooth as possible.

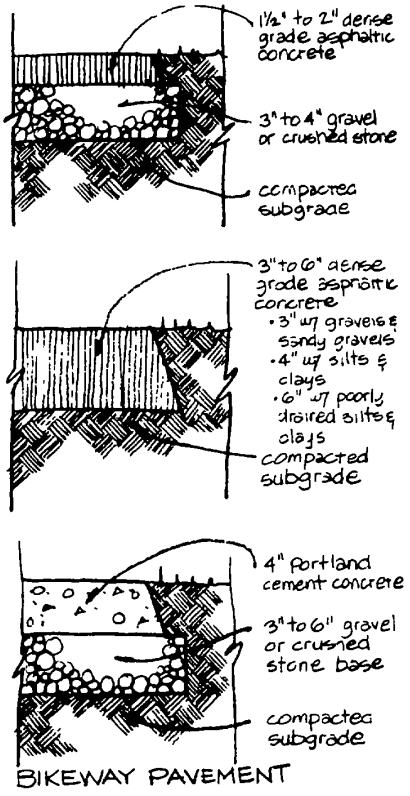


fig. 9-15.

b. Eliminate the danger of drainage grates with openings parallel to bike travel along existing street rights-of-way. Parallel grates to the bikeway should not be permitted in marked bikeways. Improved grates have been developed and modifications are possible to make existing grates safe *(fig. 9-16).* However, the effect of these alternatives on the necessary drainage capabilities of the grate must be evaluated.

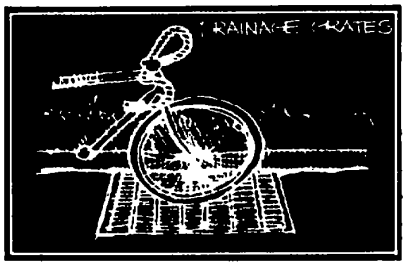


fig. 9-16.

9-5.

Street Intersections and Crossings.

A. Class I Bikeways.

When possible, shift the bikeway crossing away from the intersection *(fig. 9-17).* A high percentage of bicycle/motor vehicle accidents occur at intersections. There is no single measure, with the exception of grade separation, that will eliminate the danger of accidents to cyclists at intersections. Shifting the crossing, however, can allow a queue area for a turning motor vehicle to wait without obstructing either the bikeway or through motor vehicle movement. Shifting the crossing applies normally only to Class I bikeways.

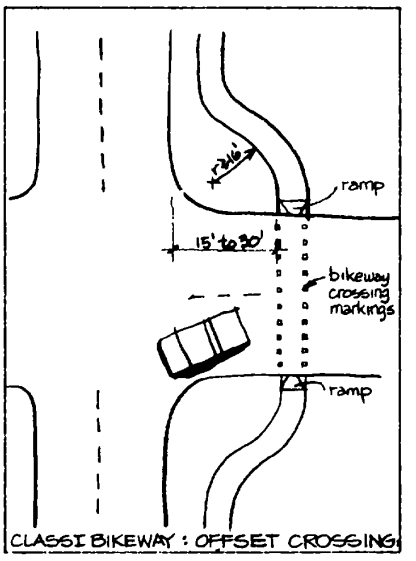


fig. 9-17.

B. Class II and III Bikeways.

When Class II and III bikeways utilize a portion of the roadway pavement, a different intersection design is required. A number of designs may be appropriate, depending on the classification of the intersecting streets and the volume of turning movements.

1. A typical design is illustrated showing the use of a broken white stripe at the intersection

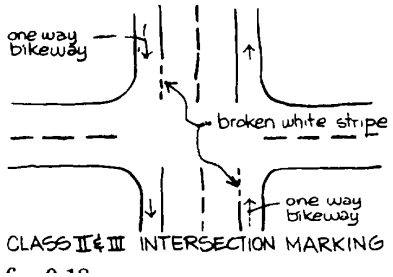


fig. 9-18.

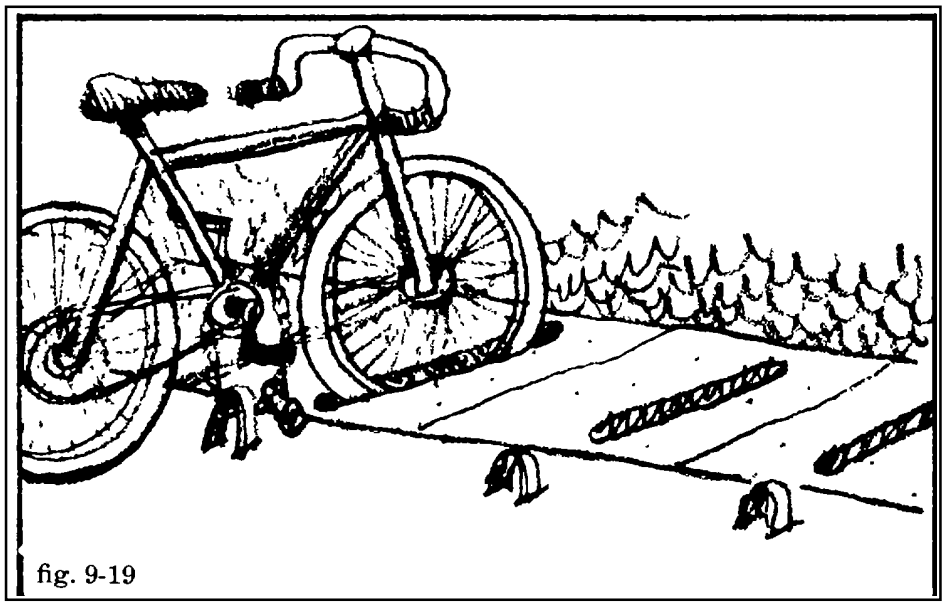


fig. 9-19

fig. 9-19.

approach, indicating that lane changing is permitted with care *(fig. 9-18).*

2. If the intersecting street is a minor one and vehicle turns are few, a continuation of either solid or broken white stripes through the intersection may be appropriate.

9-6.
Bicycle Parking.

A. Location.

1. Locate parking areas out of pedestrian pathways but in areas which are visually supervised, if possible.

2. Locate parking areas conveniently near the cyclist's destination, preferably within 50 feet of main entrances.

B. Design.

1. Provide secure racks or stanchions for bicycle parking. It is desirable to allow a wheel and the frame to be anchored to prevent detachment and theft of a portion of the bicycle *(fig. 9-19).*

2. A 2'-0" spacing between racks or stanchions is desirable to facilitate their use *(fig. 9-20).*

3. Carefully consider the design of bicycle racks or stanchions to prevent visual clutter or inharmonious appearance.

4. Avoid the indiscriminate use of portable pipe bicycle racks that do not provide a way of locking the entire bicycle.

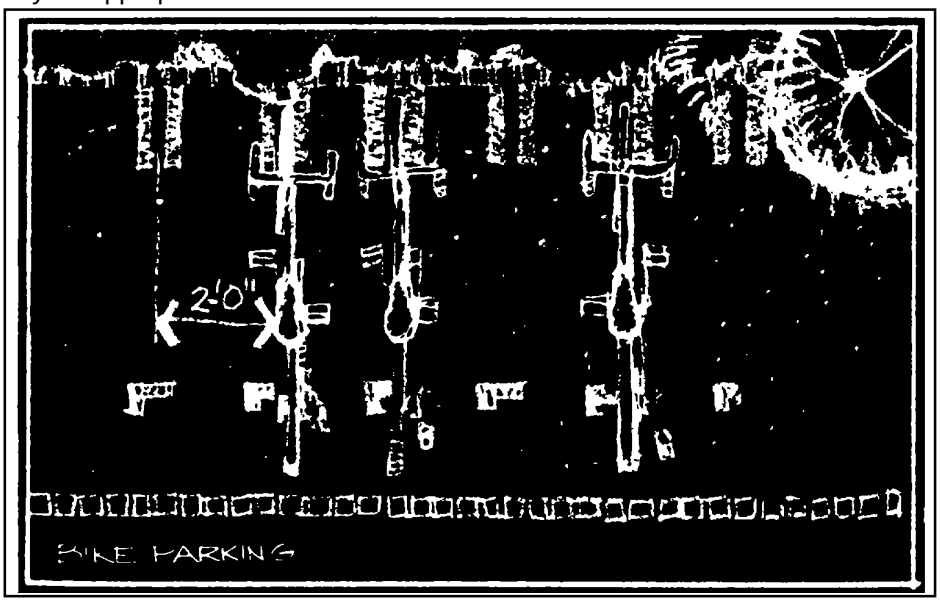


Fig. 9-20.